

[0034] Claims

What is claimed is:

1. A fuel delivery system for an internal combustion engine, said system having fuel pressure damping and comprising:

a fuel feed line;

a fuel rail defining a fuel passageway therein, said rail being connected to said feed line to receive fuel from said feed line into said passageway;

a plurality of fuel injectors connected to said rail to receive fuel from said passageway to be delivered to the engine;

a compliance member located within said system, said compliant member decreasing the bulk modulus of said system;

at least a portion of said system defining a critical element of said system, said critical element significantly contributing to a resonant mode of said system during operation wherein a pressure pulsation occurs within said system; and

a fluid flow restrictor located within said system, said restrictor being located in relation to said critical element whereby the distance (D) from said restrictor to an end of said critical element is generally defined by the equation $D = (1 - E)/0.00226$.

2. The fuel delivery system of claim 1 wherein said restrictor is located within said critical element.

3. The fuel delivery system of claim 1 wherein said restrictor is located in proximity to said critical element.

4. The fuel delivery system of claim 1 wherein said restrictor is located less than 422 mm from said critical element.

5. The fuel delivery system of claim 1 wherein said critical element is a portion of said rail.

6. The fuel delivery system of claim 1 wherein said rail includes a cross-over member located between first and second side rails.

7. The fuel delivery system of claim 6 wherein said critical element is a portion of said cross-over member.

8. The fuel delivery system of claim 6 wherein said critical member is a portion of one of said first and second side rails.

9. A fuel delivery system for an internal combustion engine, said system having fuel pressure damping and comprising:

a fuel feed line;

a fuel rail defining a fuel passageway therein, said rail being connected to said feed line to receive fuel from said feed line into said passageway;

a plurality of fuel injectors connected to said rail to receive fuel from said passageway to be delivered to the engine;

a compliance member located within said system, said compliant member decreasing the bulk modulus of said system;

at least a portion of said system defining a critical element of said system, said critical element significantly contributing to a resonant mode of said system during operation wherein a pressure pulsation occurs within said system; and

a fluid flow restrictor located within said system, said restrictor being located in relation to said critical element whereby the distance (D) from said restrictor to an end of said critical element is generally defined by the equation $D = (1 - [R_r/R_a])/0.00226$.

10. The fuel delivery system of claim 9 wherein said restrictor is located within said critical element.

11. The fuel delivery system of claim 9 wherein said restrictor is located in proximity to said critical element.

12. The fuel delivery system of claim 9 wherein said restrictor is located less than 422 mm from said critical element.

13. The fuel delivery system of claim 9 wherein said critical element is a portion of said rail.

14. The fuel delivery system of claim 9 wherein said rail includes a cross-over member located between first and second side rails.

15. The fuel delivery system of claim 14 wherein said critical element is a portion of said cross-over member.

16. The fuel delivery system of claim 14 wherein said critical member is a portion of one of said first and second side rails.

17. A fuel delivery system for an internal combustion engine, said system having fuel pressure damping and comprising:

a fuel feed line;

a fuel rail defining a fuel passageway therein, said rail being connected to said feed line to receive fuel from said feed line into said passageway;

a plurality of fuel injectors connected to said rail to receive fuel from said passageway to be delivered to the engine;

a compliance member located within said system, said compliant member decreasing the bulk modulus of said system;

at least a portion of said system defining a critical element of said system, said critical element significantly contributing to a resonant mode of said system during operation wherein a pressure pulsation occurs within said system of a magnitude beyond a predetermined limit; and

a fluid flow restrictor located within said system, said restrictor being located in relation to said critical element whereby the distance (D) from said restrictor to an end of said critical element results in a percent optimal benefit gained (E) that reduces the magnitude of the pressure pulsation to within the predetermined limit.

18. The fuel delivery system of claim 17 wherein said restrictor is located within said critical element.

19. The fuel delivery system of claim 17 wherein said restrictor is located in proximity to said critical element.

20. The fuel delivery system of claim 17 wherein the distance (D) is generally defined by the equation $D = (1 - E)/0.00226$.

21. The fuel delivery system of claim 17 wherein the percent optimal benefit gained (E) is generally defined by the equation $E = 1.00066 - 0.00107663(D) - 0.00000699496(D^2)$.